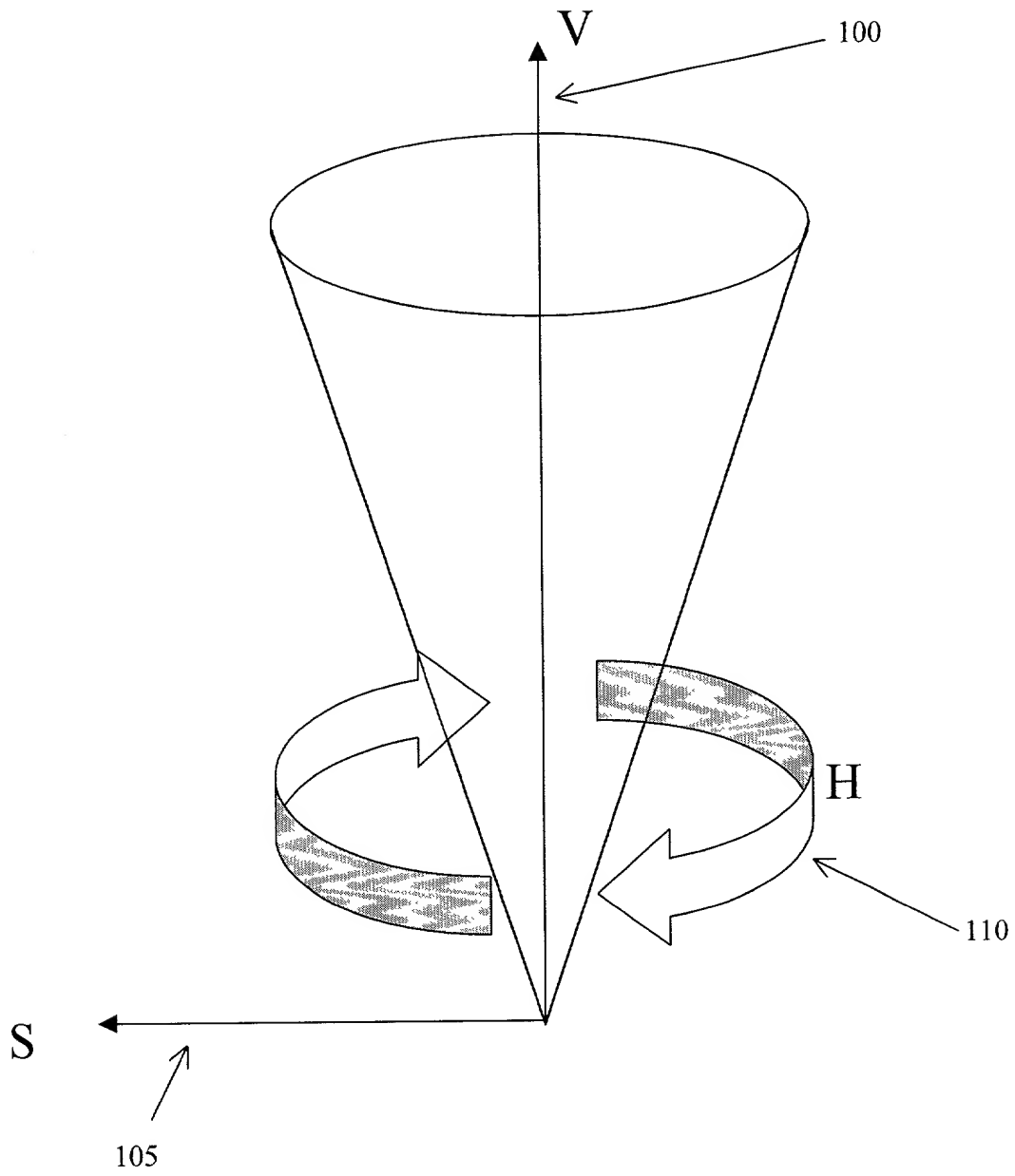

Figure 1A

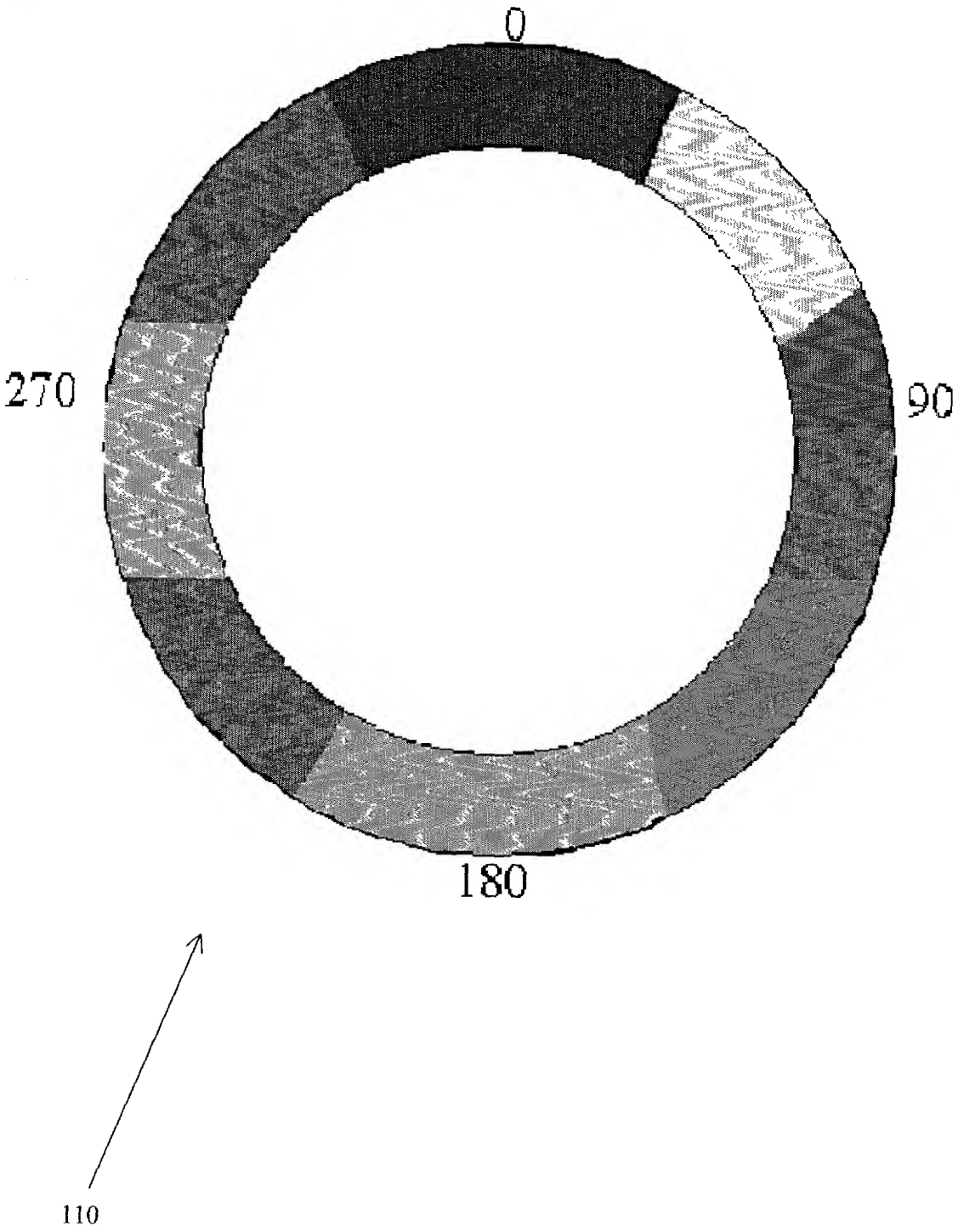

Figure 1B

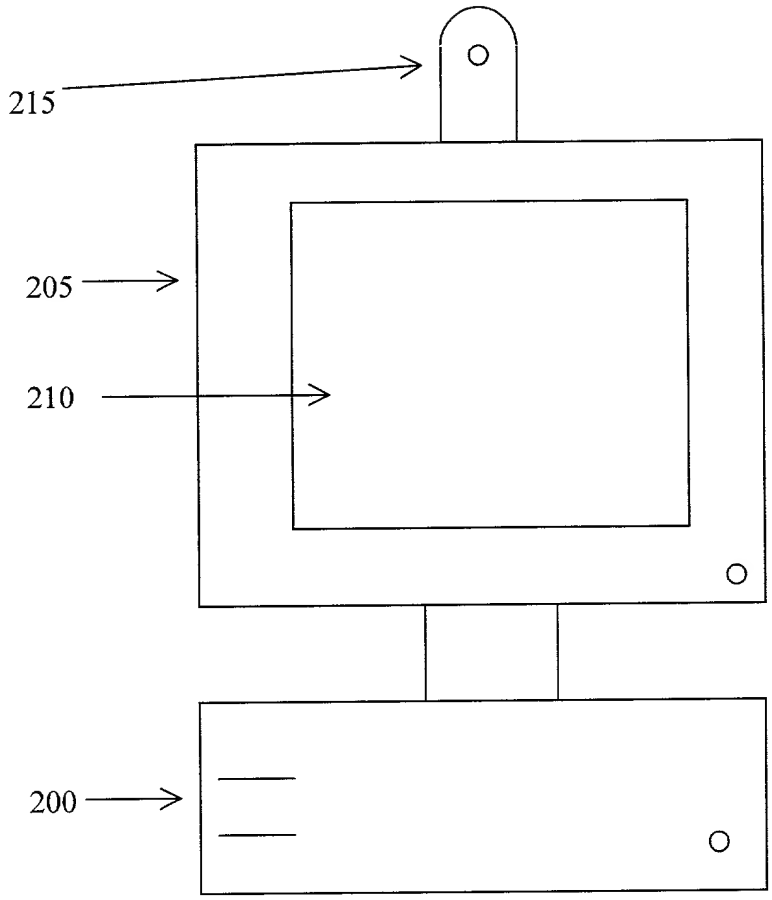

FIGURE 2

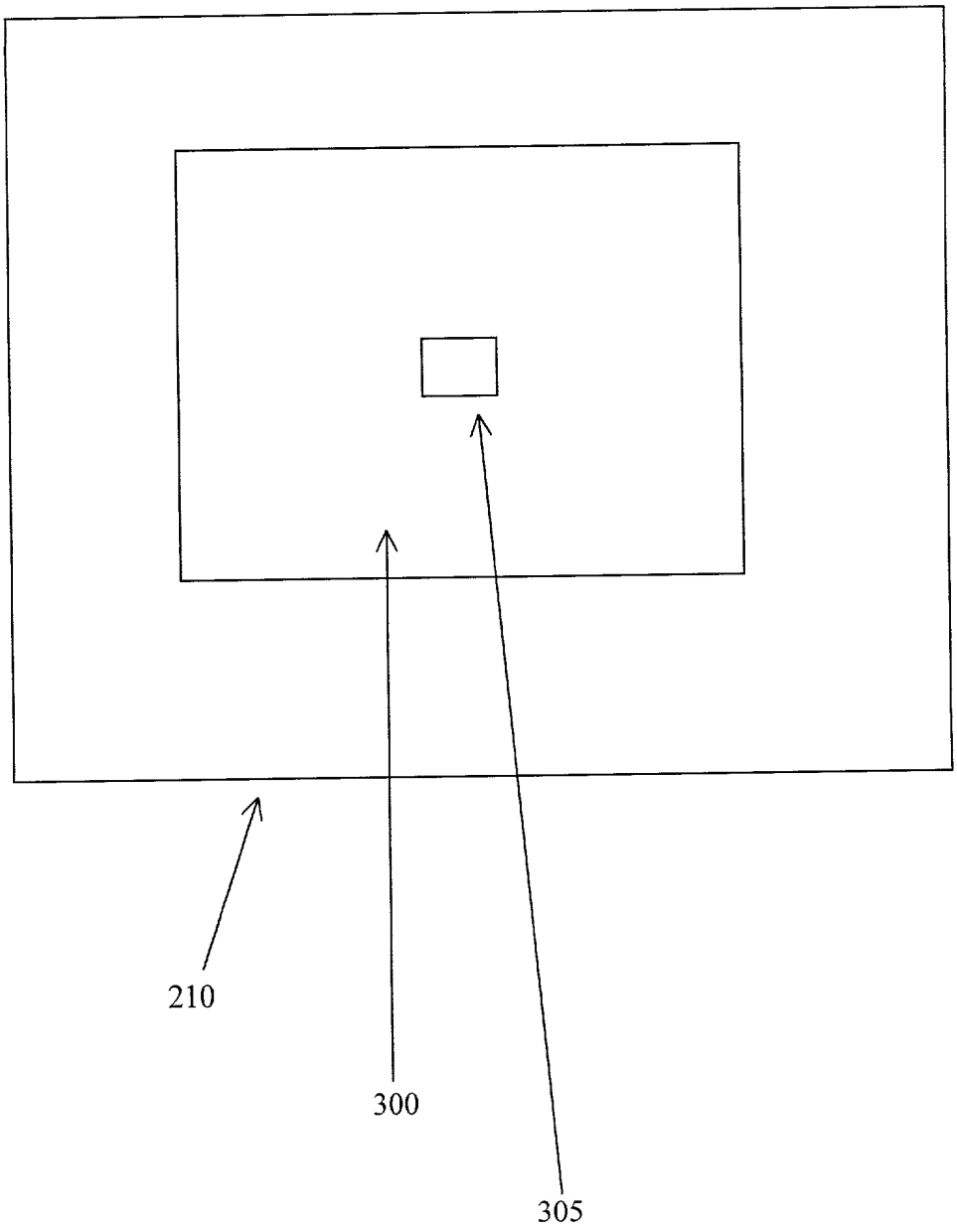

Figure 3

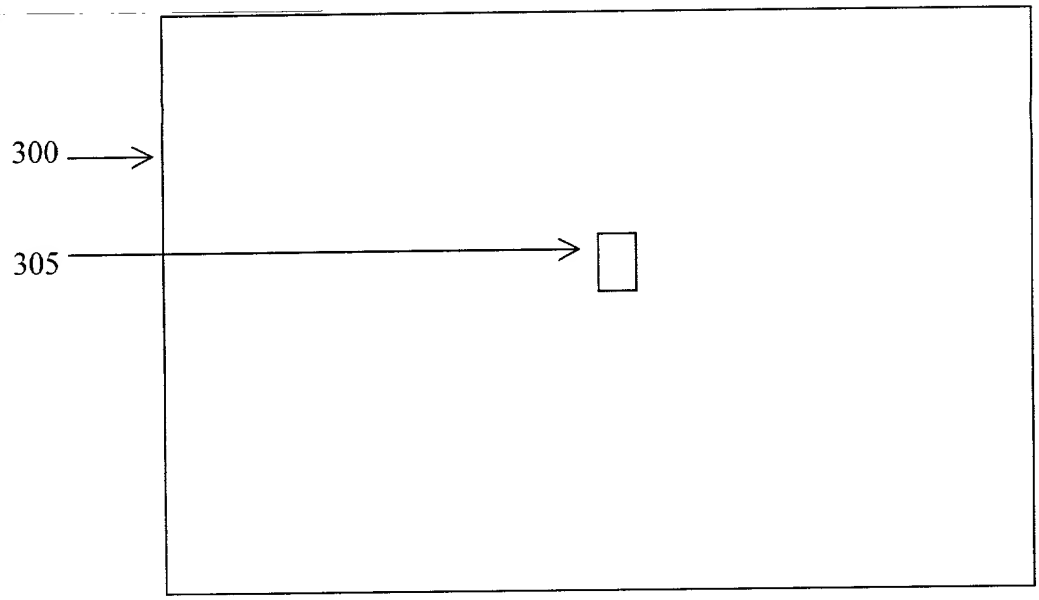

Figure 4A

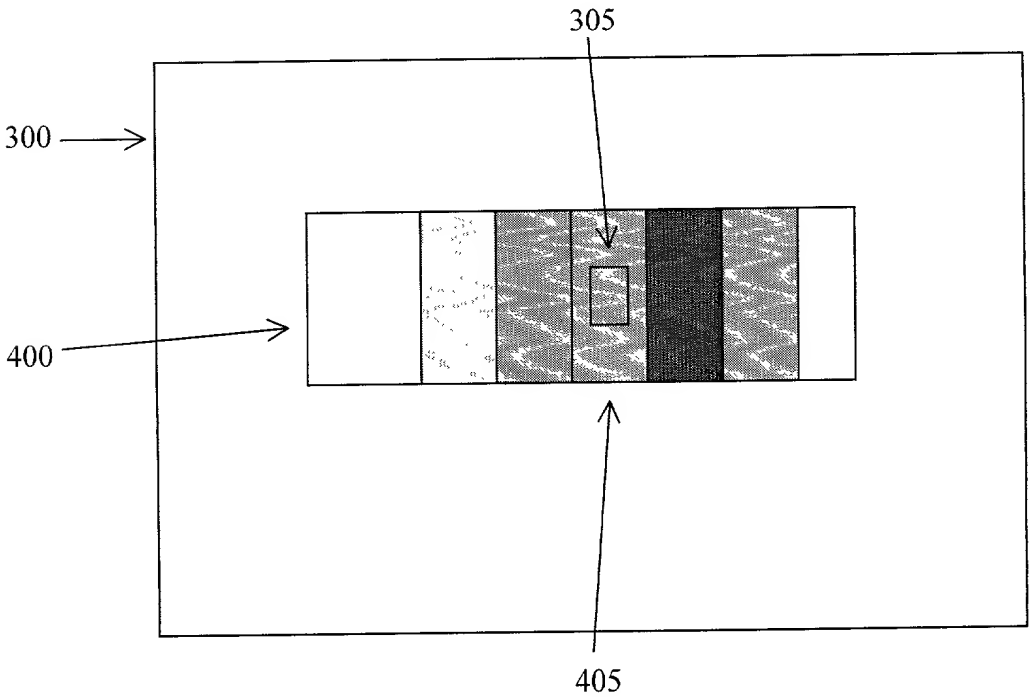

Figure 4B

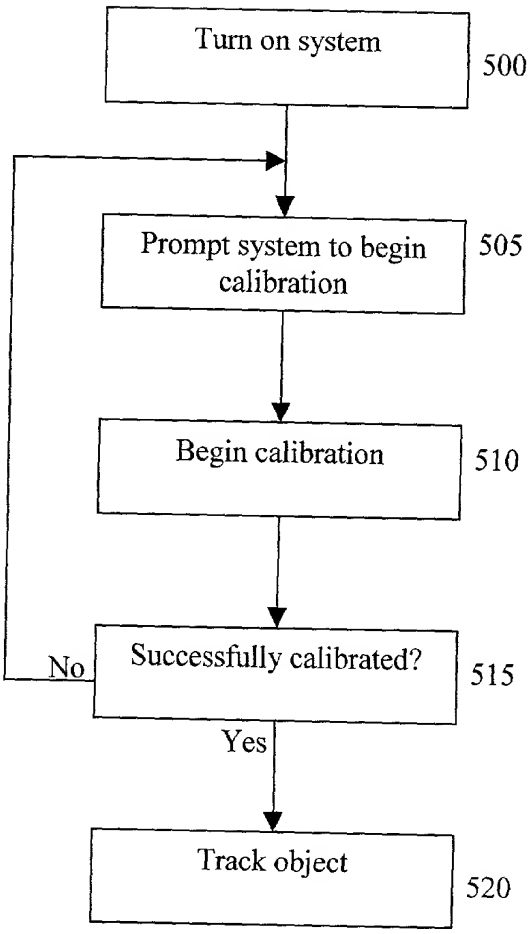
Turn on system
500
Prompt system to begin calibration
505
Begin calibration
510
Successfully calibrated?
515
No
Yes
Track object
520

Figure 5

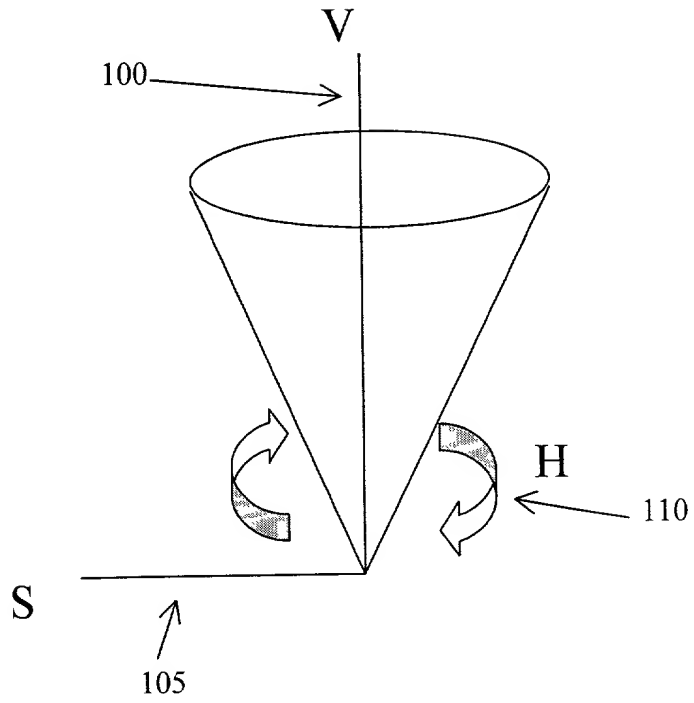

Figure 6A

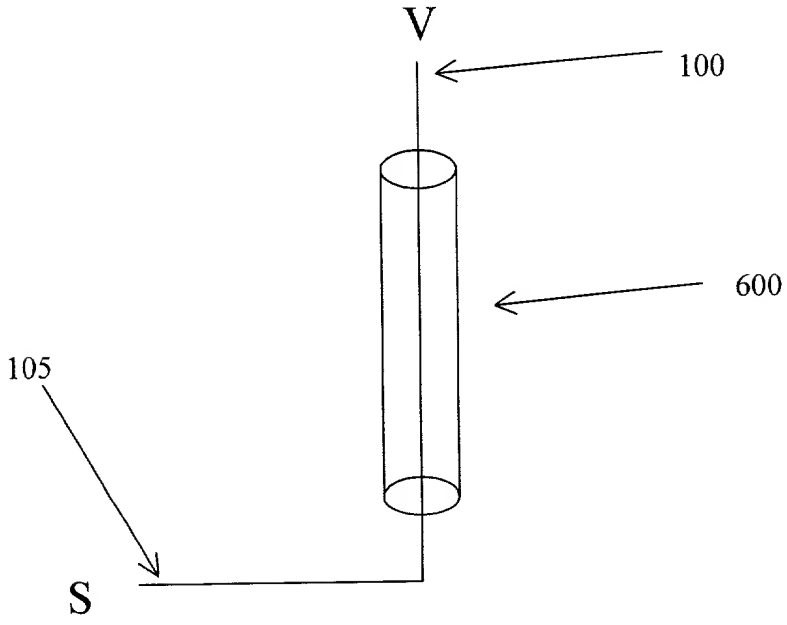

Figure 6B

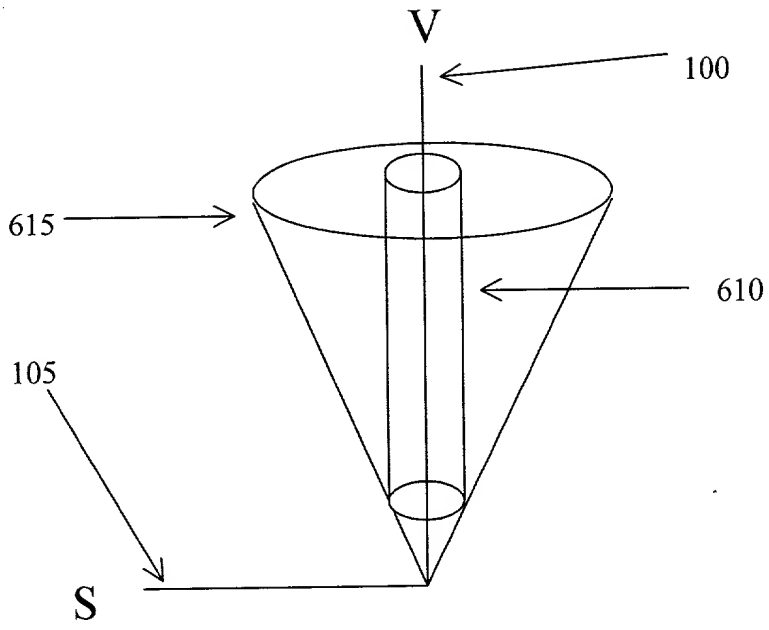

Figure 6C

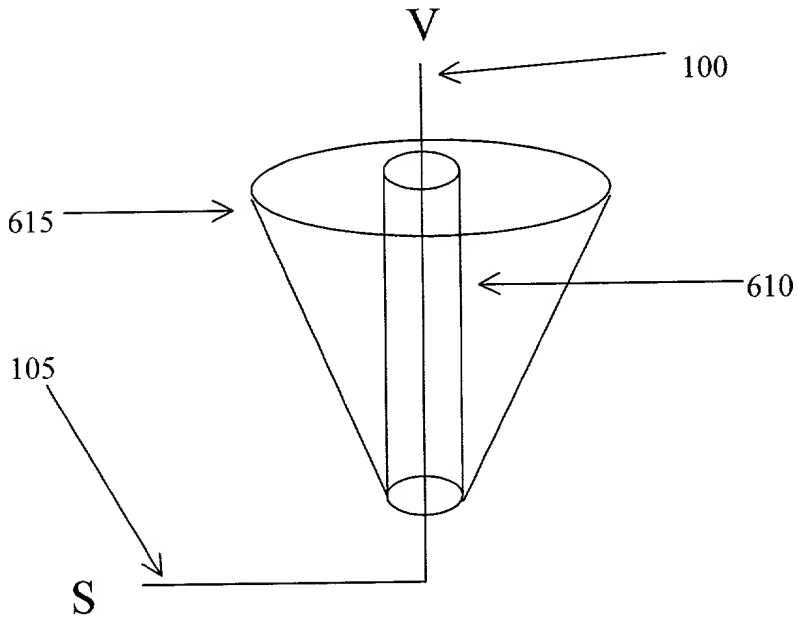

Figure 6D

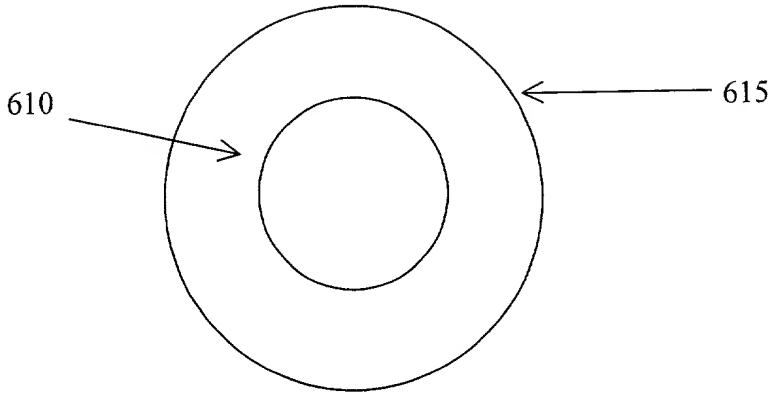

Figure 6E

Patent Application Publication

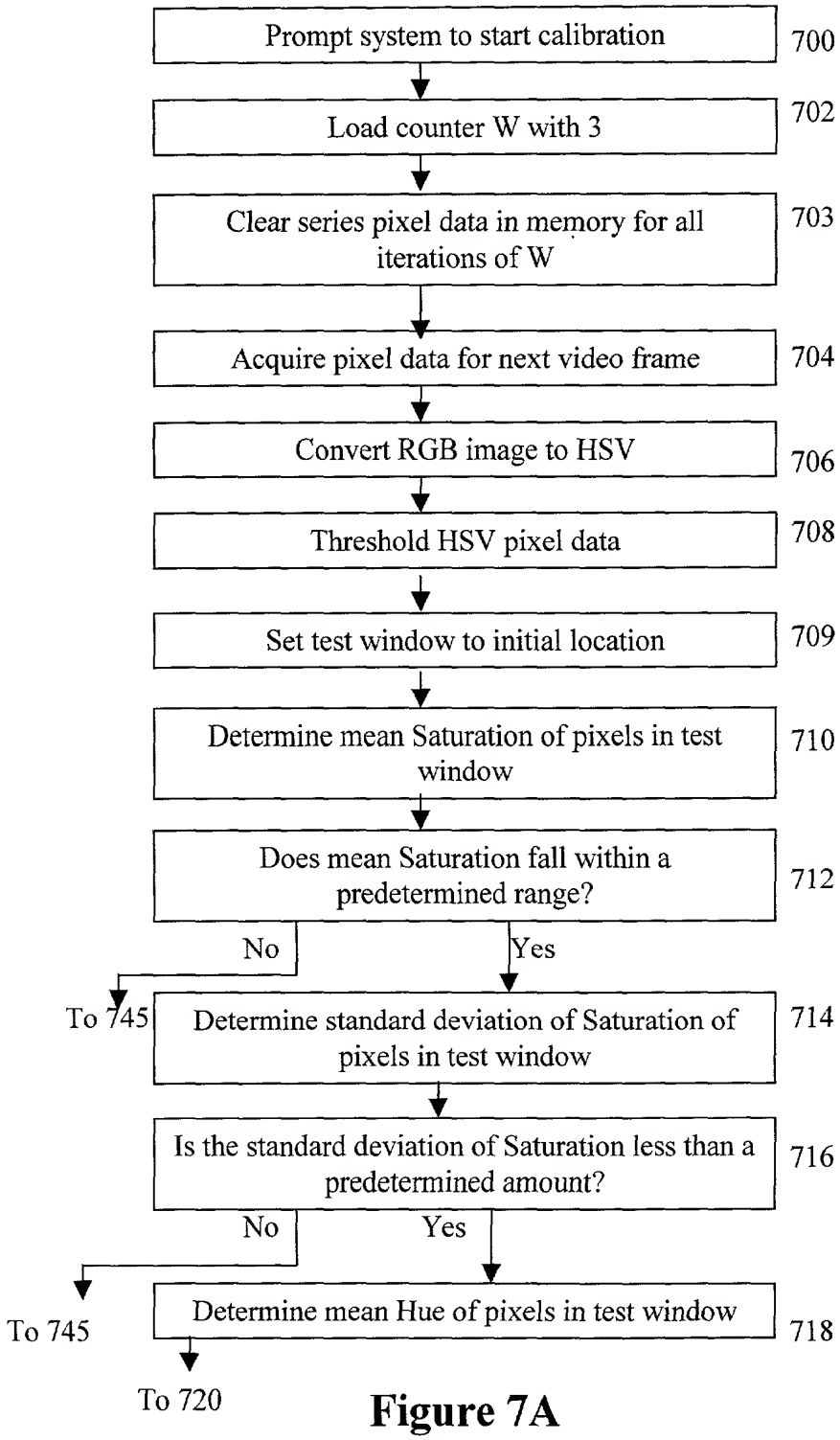
Prompt system to start calibration
700
Load counter W with 3
702
Clear series pixel data in memory for all iterations of W
703
Acquire pixel data for next video frame
704
Convert RGB image to HSV
706
Threshold HSV pixel data
708
Set test window to initial location
709
Determine mean Saturation of pixels in test window
710
Does mean Saturation fall within a predetermined range?
712
No
Yes
To 745
Determine standard deviation of Saturation of pixels in test window
714
Is the standard deviation of Saturation less than a predetermined amount?
716
No
Yes
To 745
Determine mean Hue of pixels in test window
718
To 720

Figure 7A

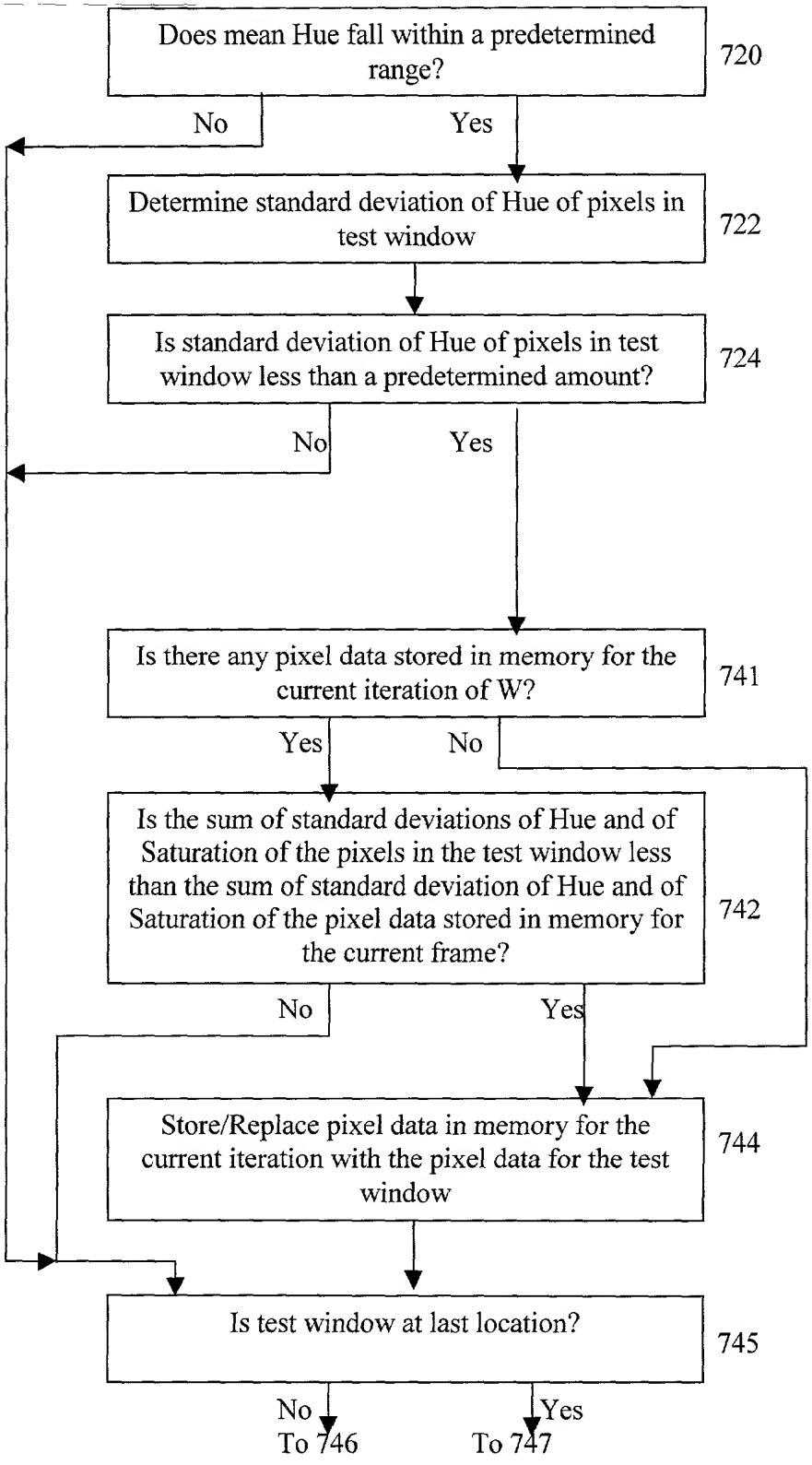
Does mean Hue fall within a predetermined range?
720
No
Yes
Determine standard deviation of Hue of pixels in test window
722
Is standard deviation of Hue of pixels in test window less than a predetermined amount?
724
No
Yes
Is there any pixel data stored in memory for the current iteration of W?
741
Yes
No
Is the sum of standard deviations of Hue and of Saturation of the pixels in the test window less than the sum of standard deviation of Hue and of Saturation of the pixel data stored in memory for the current frame?
742
No
Yes
Store/Replace pixel data in memory for the current iteration with the pixel data for the test window
744
Is test window at last location?
745
No
To 746
Yes
To 747

Figure 7B

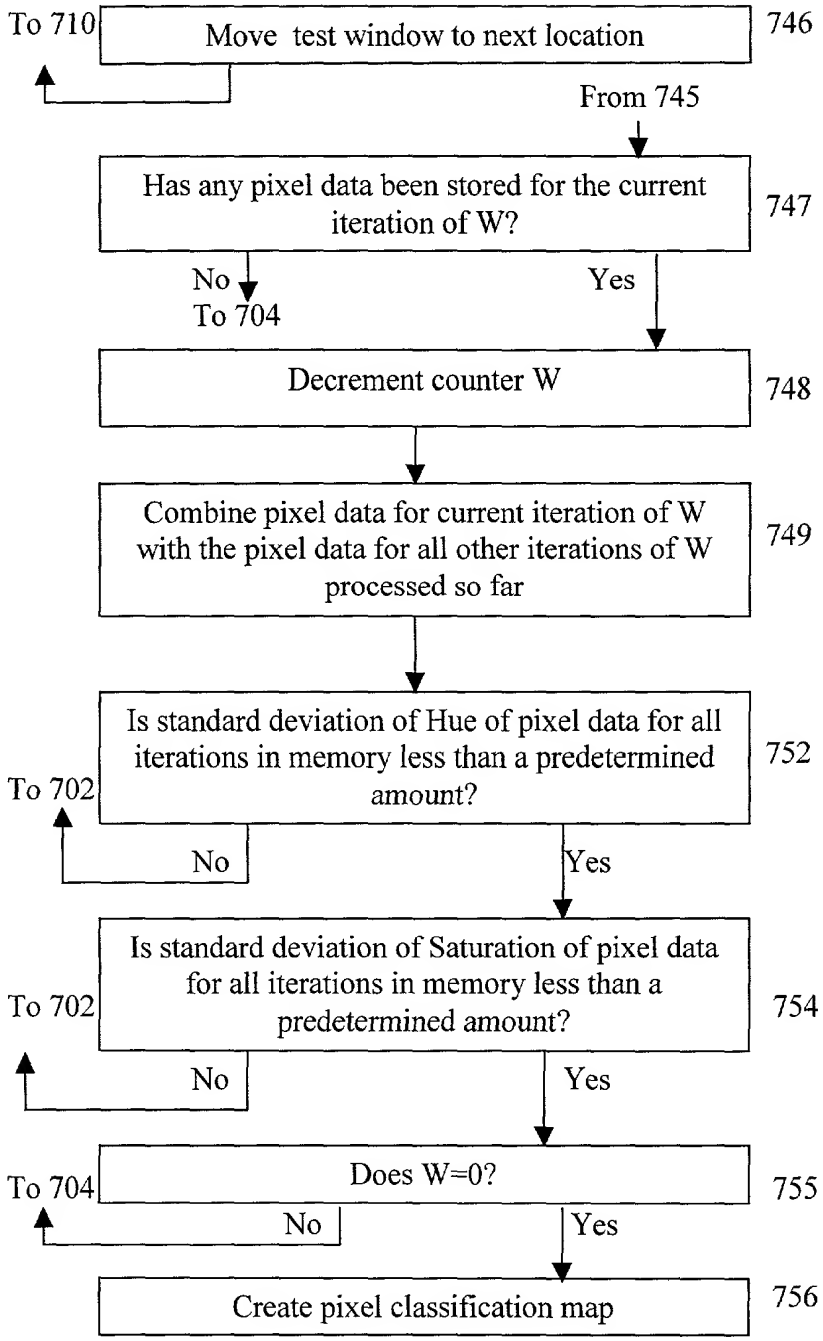
To 710
Move test window to next location
746
From 745
Has any pixel data been stored for the current iteration of W?
747
No
To 704
Yes
Decrement counter W
748
Combine pixel data for current iteration of W with the pixel data for all other iterations of W processed so far
749
Is standard deviation of Hue of pixel data for all iterations in memory less than a predetermined amount?
752
To 702
No
Yes
Is standard deviation of Saturation of pixel data for all iterations in memory less than a predetermined amount?
754
To 702
No
Yes
Does W=0?
755
To 704
No
Yes
Create pixel classification map
756

Figure 7C

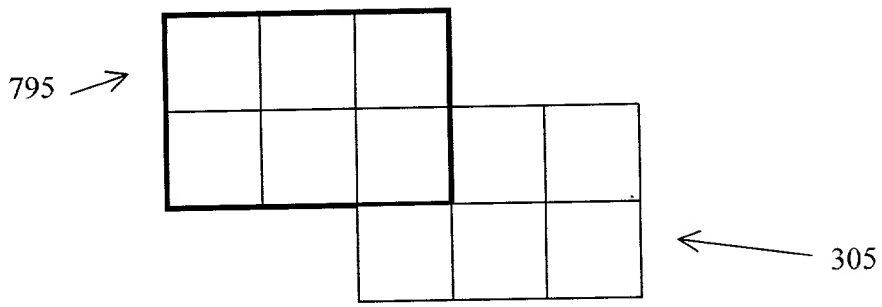

Figure 7D

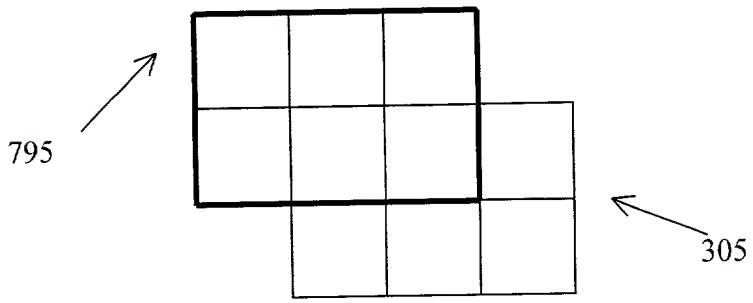

Figure 7E

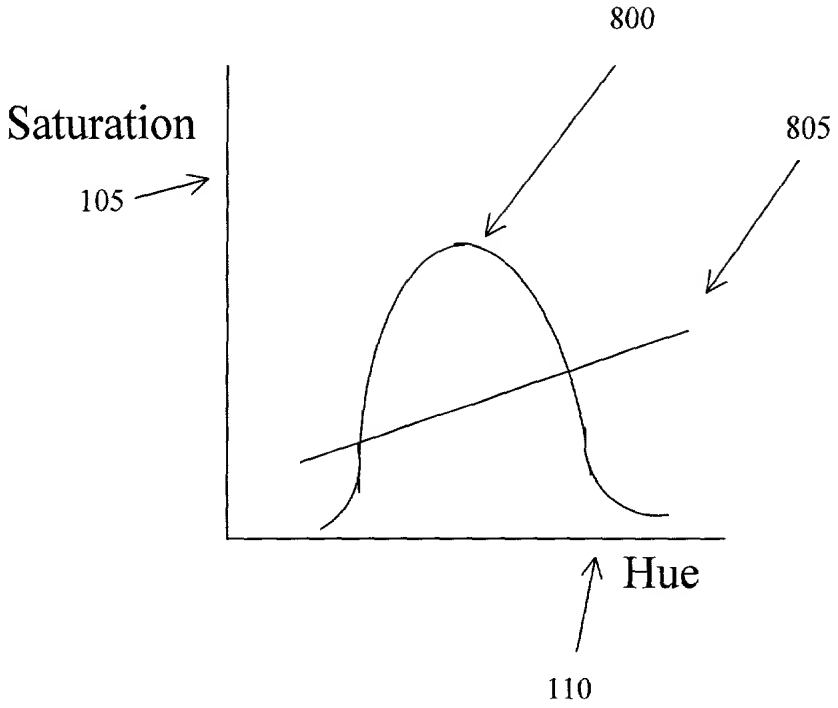

Figure 8A

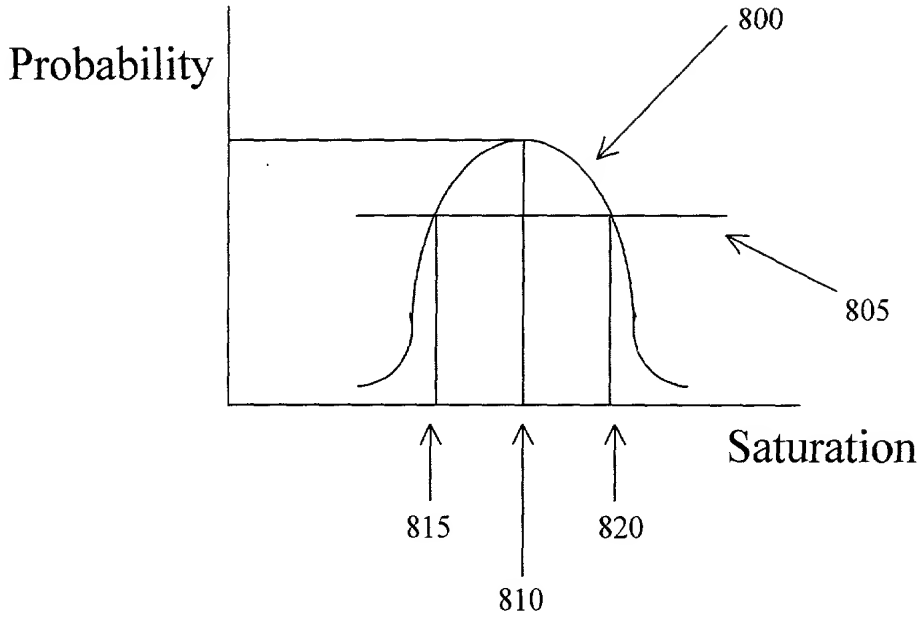

Figure 8B

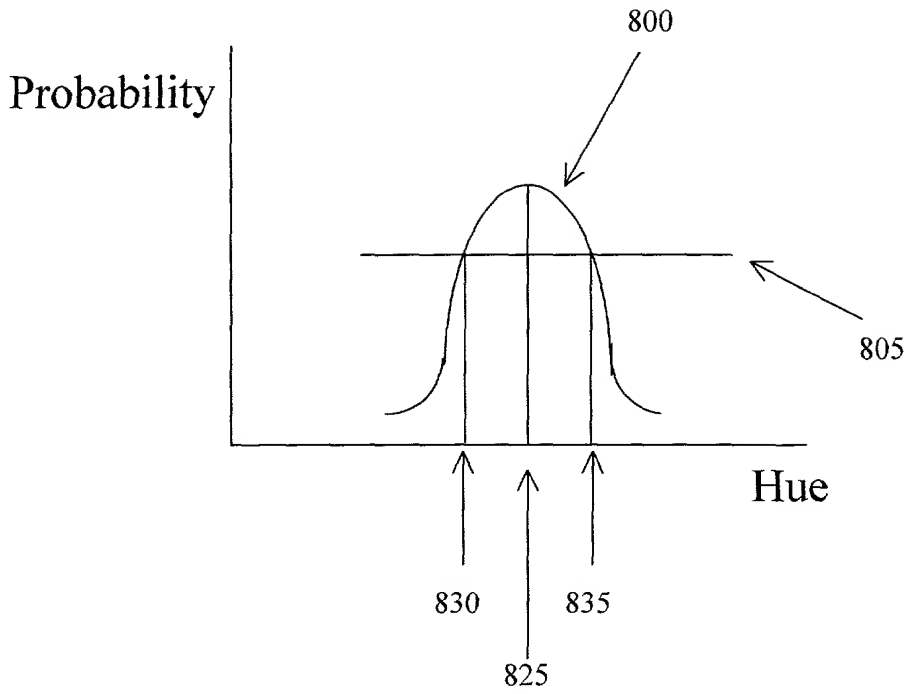

Figure 8C

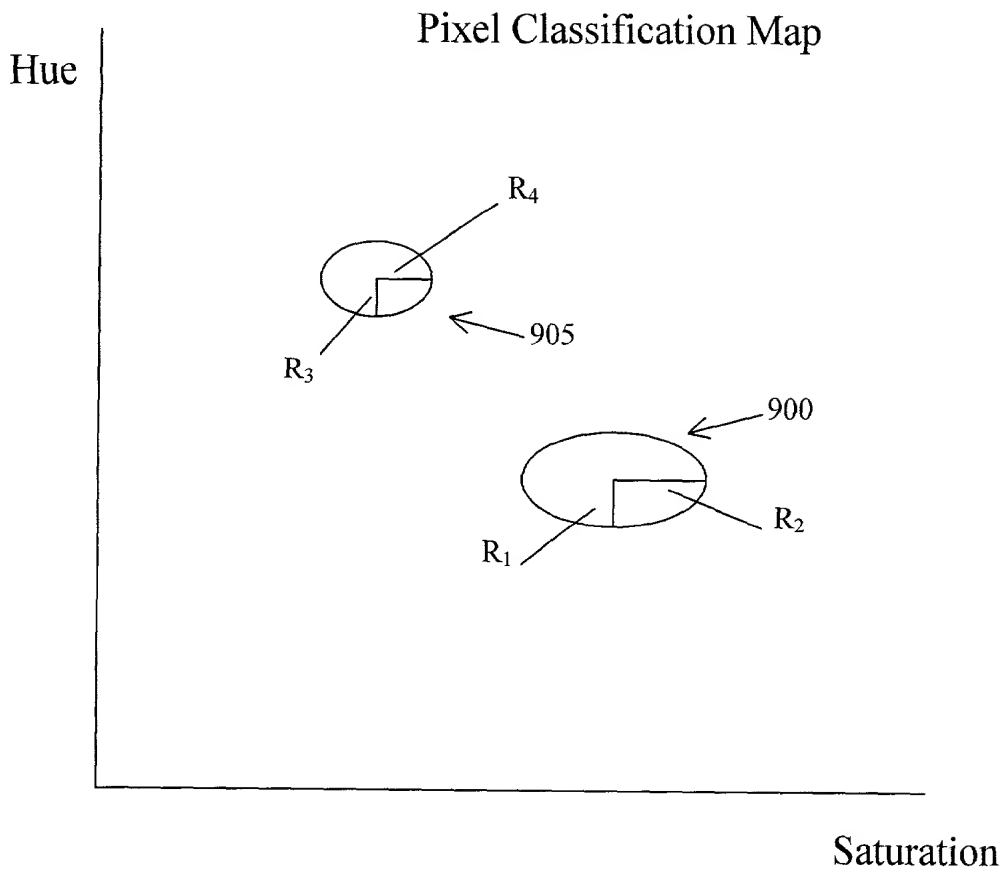

Figure 9

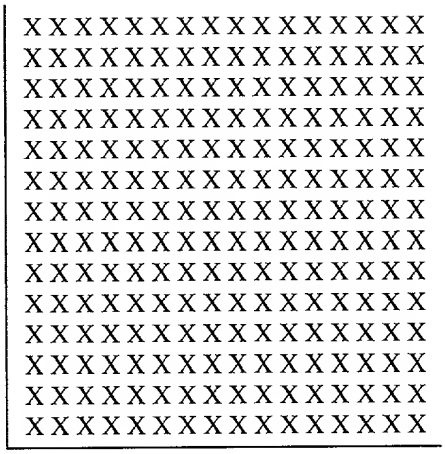

Figure 10

5,850,470

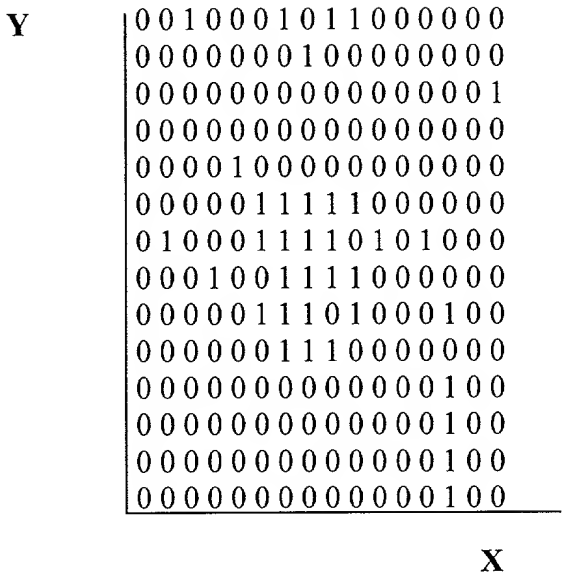

Figure 11

Patent Application Publication

Histogram in X-direction

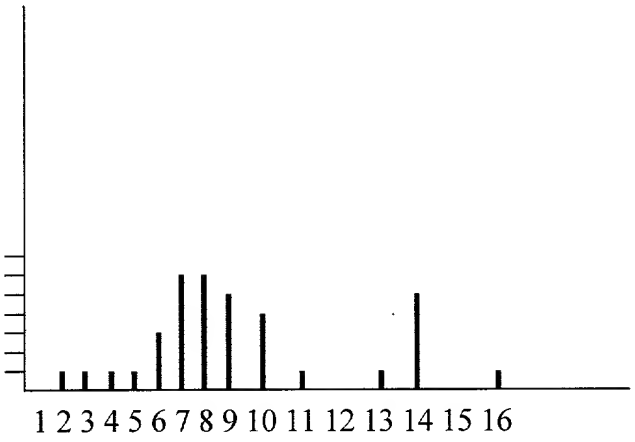

Figure 12A

D5860502 - 060604

Histogram in X-direction after application of low-pass filter

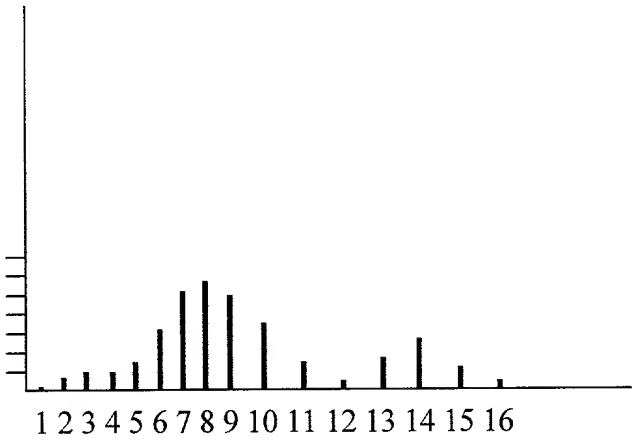

Figure 12B

Patent Application Publication

Histogram in Y-direction

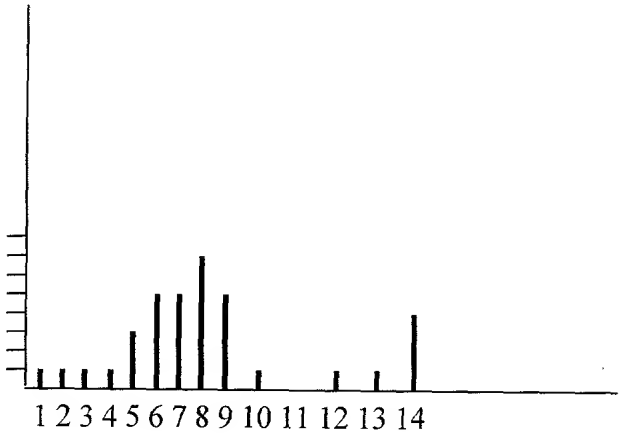

Figure 13A

Histogram in Y-direction after application of low-pass filter

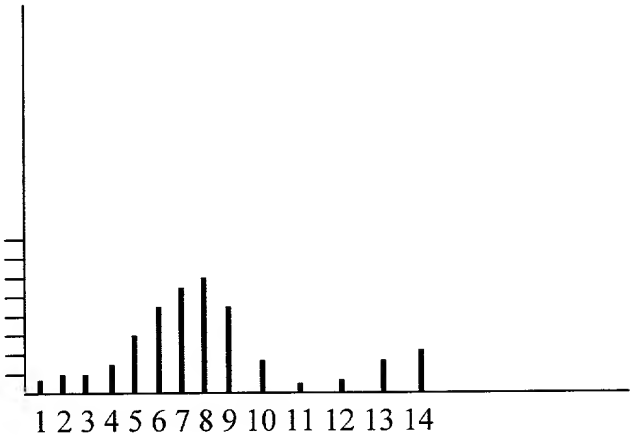

Figure 13B

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Histogram in X-direction (After thresholding)

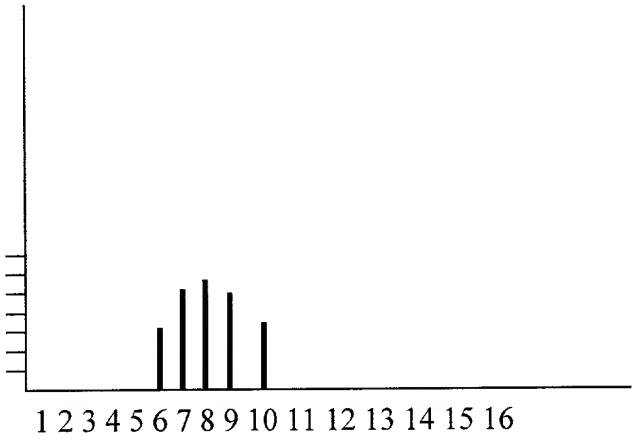

Figure 14

Patent Application Publication

Histogram in Y-direction (After thresholding)

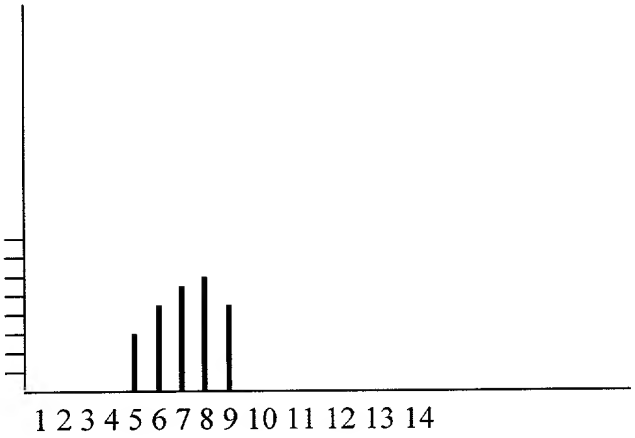

Figure 15

Search Window

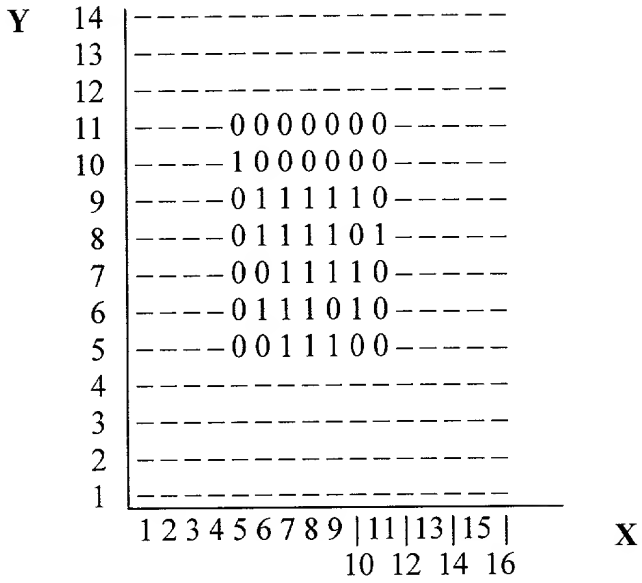

Figure 16

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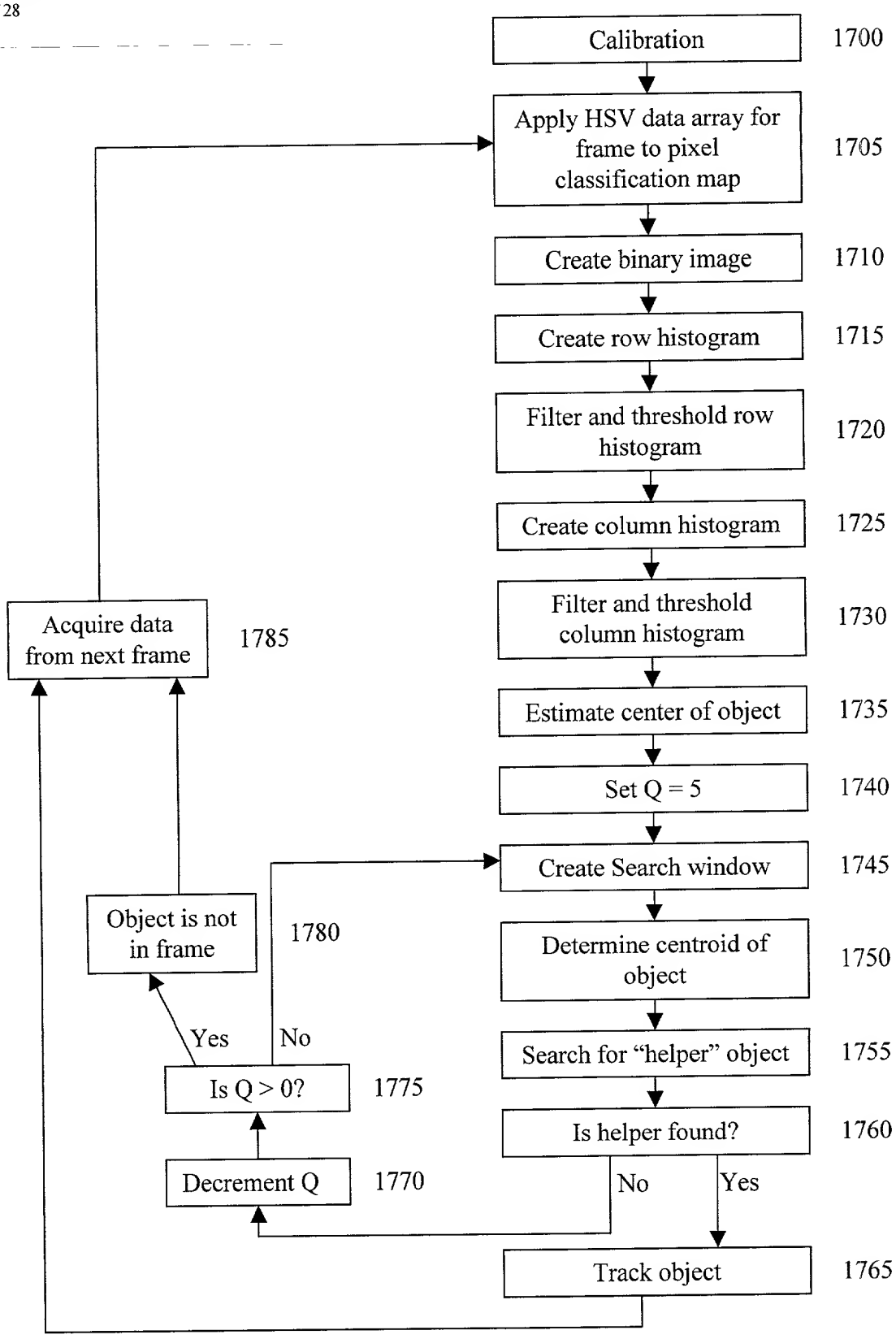
Calibration
1700
Apply HSV data array for frame to pixel classification map
1705
Create binary image
1710
Create row histogram
1715
Filter and threshold row histogram
1720
Create column histogram
1725
Filter and threshold column histogram
1730
Estimate center of object
1735
Set Q = 5
1740
Create Search window
1745
Determine centroid of object
1750
Search for "helper" object
1755
Is helper found?
1760
No
Yes
Track object
1765
Decrement Q
1770
Is Q > 0?
1775
Yes
No
Object is not in frame
1780
Acquire data from next frame
1785

Figure 17

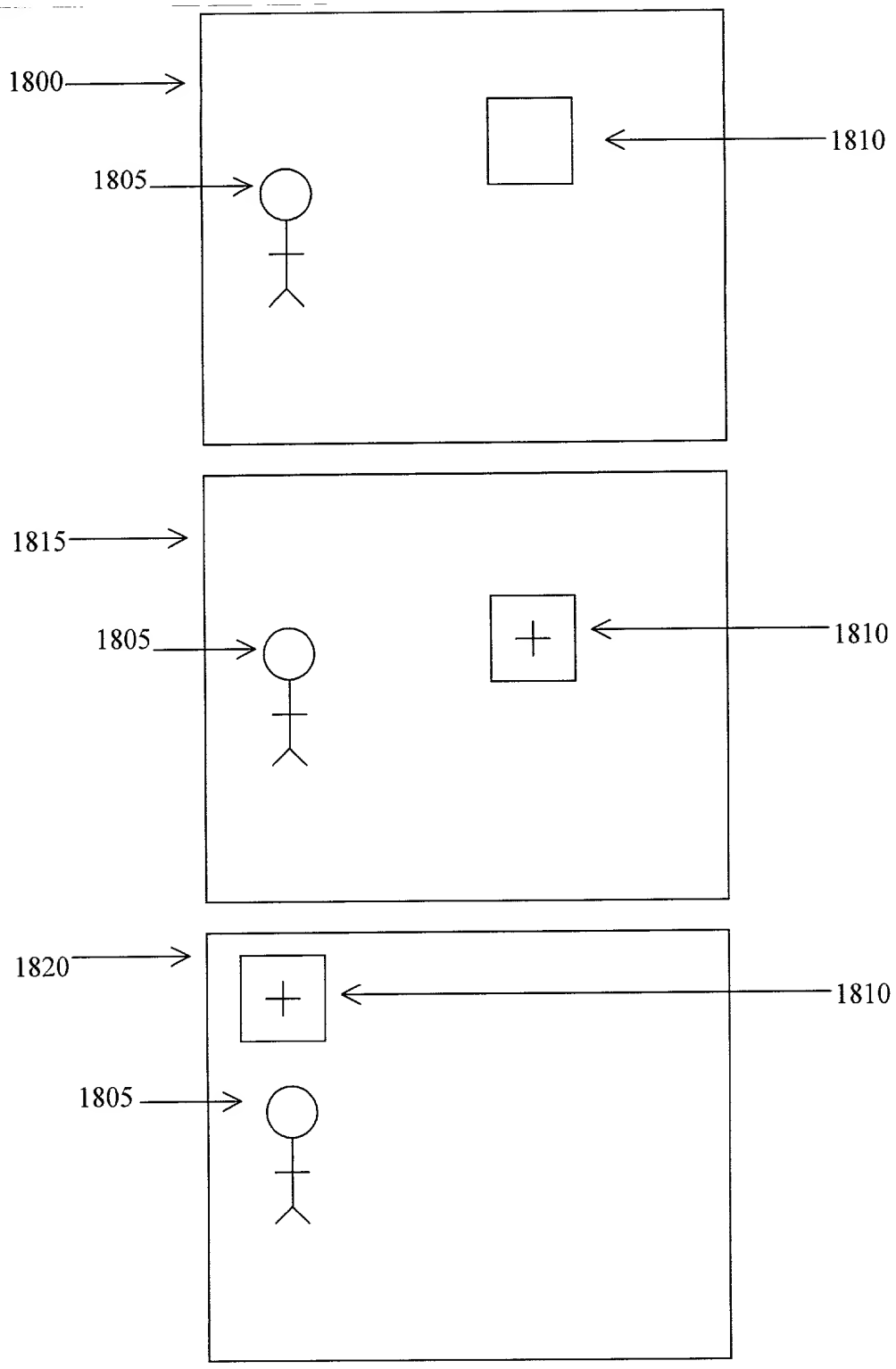

Figure 18